

## **Commonwealth of Virginia**



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### **Information Technology Resource Management Guideline**

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### **Estimating Alternative Technology Systems Costs**

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## Preface

**PUBLICATION DESIGNATION**

COV ITRM Guideline 92-3

guidelines for managing information technology resources.

**SUBJECT**

Estimating Alternative Technology Systems Costs.

***The Department of Information Technology (DIT)***

Responsible for providing administrative support to the Council and performing such other services as the Council may direct in the performance of its powers and duties. Support may include advising the Council in the development, interpretation, and dissemination of its policies, standards, and guidelines, and maintaining records thereon for the Council.

**EFFECTIVE DATE**

June 26, 1992

**AUTHORITY**

*Code of Virginia*, Section 2.1-563.31 (Powers and Duties of the Council on Information Management).

*Code of Virginia*, Section 2.1-563.17 (Powers and Duties of the Department of Information Technology).

***All State Agencies***

Responsible for complying with the Council's policies, standards, and guidelines for managing information technology resources in the Commonwealth.

**SCOPE**

This guideline is applicable to all State agencies and institutions of higher education (hereinafter collectively referred to as "agency") that are engaged in such functions as planning, managing, developing, purchasing and using information technology resources in the Commonwealth.

**PURPOSE**

This guideline provides a financial framework for evaluating alternative information technology acquisitions being considered by an agency. It provides cost documentation to assist management in reviewing acquisitions.

**OBJECTIVE**

To provide a methodology for identifying and documenting financial items important to evaluating alternative technologies.

**GENERAL RESPONSIBILITIES**

In accordance with the *Code of Virginia*, the following provisions apply:

***The Council on Information Management (CIM)***

Responsible for directing the development and promulgation of policies, standards, and guidelines for managing information technology resources in the Commonwealth.

***Advisory Committees***

Responsible for meeting with, conferring and advising the Council in the development of the Commonwealth's policies, standards, and

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## **SECTION 1**

### **INTRODUCTION**

State agencies generally analyze costs and benefits before authorizing major purchases. The more complex and expensive the acquisition, the more important the need becomes for well founded and well documented supportive analysis. This guideline presents a useful and easily followed approach for doing an economic analysis.

### **BUSINESS CONSIDERATIONS**

Acquisition is based on the influence of three decision areas: managerial, technical, and financial. Each area exerts influence depending on existing circumstances, and one may dominate the final decision. The preferred alternative may not have the lowest cost or greatest economic benefit, but the broader agency view may justify acquisition.

This guideline addresses the financial considerations for making a decision. Costs, benefits and risks are identified through a clear economic analysis that leads to a recommended alternative.

Managerial and technological considerations are unique to each agency. Alternatives should be screened using these criteria prior to starting the financial and economic review process.

### **GUIDELINE FEATURES**

Cost/Benefit Analysis is a systematic approach to estimating the strengths and weaknesses of alternatives meeting agency technological requirements. To help individuals prepare cost/benefit comparisons, this guideline provides a direct approach to gathering information, presenting costs, determining benefits, identifying risks and drawing economically sound conclusions. The guideline incorporates the following features:

- Methodology Oriented Approach. Like a "cookbook," this guideline provides steps for doing an economic analysis.
- Use of Spreadsheets. The methodology is oriented toward automated spreadsheet technology to simplify the analysis.
- Adaptability to Existing Agency Work Practices. Agencies currently doing cost/benefit analyses can use this guideline without rewriting existing procedures.
- Use of Budget Development Expenditure Structure. Guideline formats allow agencies to associate cost and benefit categories to potential budget items by using expenditure structures published by the Virginia Department of Planning and Budget. (See Appendix A)

- Basis in Proven and Current Techniques. This guideline follows established financial practices for economic analysis. (See Appendix G)
- Generic in Nature. It can be applied to all technology acquisitions considered appropriate by the organization.
- Presents Examples. A recent project at the Department of Corrections is used as a case study for cost and benefit development and comparison.
- Incorporates Cost of Ownership. Costs are estimated for the entire life of the technology to include a comprehensive consideration of one-time and ongoing expenses.
- Time Value of Money. The financial considerations acknowledging that dollars earned or spent in the future are not worth the same as dollars today.

## **ECONOMIC ANALYSIS CONSIDERATIONS**

The return expected from an economic analysis should justify the time and money spent.

An economic analysis for acquiring a new system or updating an existing one should include "go/no go" decisions at established control points in the system development life cycle. Control points increase the opportunities for reviewing the analysis and help ensure economically consistent system development and implementation.

The model uses constant dollar values for comparing costs over the technology's life. Constant dollars represent a cost planning tool that projects the buying power of today's money into the future. To give constant dollars meaning, a base-line year is chosen as the purchase power standard. Problems arise when constant dollars are used for budget projections. Adjust the constant dollars for inflation before using them in budget planning.

When possible, test the reasonableness of the analysis by comparing it to similar evaluations. Unfounded assumptions and estimates can be discovered through feedback from other projects dealing with similar circumstances. Do this before preparing and submitting the recommendation to management.

## SECTION 2

### PREPARING AN ECONOMIC ANALYSIS

Careful analysis increases the chances that acquisition decisions are economical and effective. Before beginning the economic analysis, the current technology is reviewed and additional technological requirements are identified. Potential alternatives are identified which satisfy those requirements in terms of managerial and technical considerations. Each potential alternative is reviewed in terms of its acquisition, implementation, and use. At this point, an economic analysis is done to evaluate costs and financial benefits of each alternative.

The analysis process is divided into four primary steps, with each step containing sub-steps. The process supports spreadsheet-oriented worksheets for data collection and manipulation. These worksheets are progressive, beginning with the most detailed and advancing to summary formats.

Worksheets for analyzing all alternatives can be set up and completed concurrently as information becomes available.

A completed set of worksheets contains detailed information supporting each alternative and summary information that compares the alternatives. This information provides well defined support for choosing a recommended solution.

Cost/Benefit analysis should be initiated as early in the acquisition cycle as possible. Functionality can be increased if alternative technologies are identified and examined as design analysis is being done. Cost/Benefit analysis should not be relegated to the end of a project or acquisition.

Economic analysis can be used for independent purchases to qualify competing technologies, or as a subordinate step supporting a project. If used for independent purchases, a series of questions should be asked to identify user requirements, and establish the functionality required of the competing products. Appendix B provides sample questions that give the analyst a basic understanding of the requirements driving a purchase and benefits anticipated from the technology when received.

When used in conjunction with a project development life cycle, requirements should be identified during initial project phases and used in the Cost/Benefit analysis. Conformation of requirements and anticipated benefits can be accomplished by using more detailed questions as the project progresses.

The outcome of an economic analysis is influenced by the anticipated useful life of the technology under consideration. Traditionally, five years has been used as the minimum useful life of these purchases. However, the current pace of hardware and software advances make shorter time frames justifiable. The useful life of a proposed purchase is determined by the purchasing organization. It may include residual uses for the item beyond the area for which it was purchased. Regardless of the what useful life is assumed, it is imperative that the same time frame be used to evaluate all alternatives being considered.

**STEP 1. PREPARE COST ANALYSIS FOR EACH ALTERNATIVE**

This step determines the costs associated with each alternative.

**Step 1.1 Set up the Cost Worksheet**

Costs are the potential resources consumed by the technology being considered. At the top level, costs fall into four primary categories of acquisition, implementation, annual operation, and annual maintenance. Each primary category is subdivided into five secondary levels representing personnel, facilities, equipment (hardware and supplies), communications, and software costs. If the technology warrants, secondary levels are further subdivided.

The acquisition and implementation of an alternative influences existing agency operations. Realistically estimating the cost of this impact is part of the overall analysis. These estimated costs include:

- Training of staff
- Change in staff requirements
- Change in physical space
- Facilities improvements
- Removal of surplus equipment
- Conversion to new software, hardware, and operating systems
- Indirect cost assessments

Appendix A contains a sample Cost Worksheet and instructions.

**Step 1.2 Define the Current Technology Systems Cost**

It is important first to define the costs of a baseline technology against which each alternative solution is evaluated. If there is no technology in place, choose one of the alternatives as the baseline and justify this decision in the analysis.

**Step 1.3 Determine Alternative Technology Systems Cost**

Thoroughly review and document each alternative solution to establish a reasonable cost estimate. Prior RFP's, state contract lists, vendor resources, current users of technologies under consideration, and third party acquisition reference material are sources for gathering background information. Maintain sources and resources used for estimating costs of each alternative as supporting documentation.

**STEP 2. PREPARE BENEFIT ANALYSIS FOR EACH ALTERNATIVE**

This step documents the tangible and semi-tangible benefits associated with each alternative.

**Step 2.1 Set up the Benefit Worksheet**

Use the same alternative established in step 1.2 for the benefit worksheet baseline. This alternative represents a cost baseline for establishing the value of benefits associated with other alternatives.

When costs for the baseline are compared to themselves, the resulting benefit is zero. Therefore, a benefit worksheet is not required for the baseline alternative.

Appendix B contains a sample Benefit Worksheet and instructions.

### **Step 2.2 Determine Tangible Benefits**

Tangible benefits originate from increased revenue, cost reduction and cost avoidance. They measure, in dollar savings, the impact of an alternative on people, equipment, time, space and facilities, and support materials.

### **Step 2.3 Determine and Quantify Semi-tangible Benefits**

For use in the analysis, reduce semi-tangible benefits to a single estimated value. Weighted analysis provides a method of determining savings resulting from semi-tangible benefits. This method handles value ranges by assigning a percentage of probability to a series of values within the range. The values that are most likely to be realized are given the highest percentages, and those least likely to materialize are given the lowest percentages. The total of all percentages must equal 1.0. The selected values are multiplied by the percentages, and the results added. This sum of the multiplication results is the single amount used to represent the semi-tangible benefit value. The Bayesian approach was used as the model for the weighted analysis.

Depending on the nature of the alternative, semi-tangible benefits can include:

- Envisioned new software
- Projected technology usage growth patterns
- Management efficiencies such as:
  - Improved inventory control to reduce the carrying cost of seldom used items
  - Improved monitoring of cash flow and accounts receivable
  - More accurate or timely reports for management decision making
  - Improved agency compliance with statutory requirements

## **STEP 3. EVALUATE INTANGIBLE BENEFITS**

This step identifies and documents intangible benefits for each alternative. These benefits are subjective issues that can exert strong influences on the alternative selection process, but can seldom be measured in dollar terms. Intangible benefits are represented by:

- Improved service
- Better and more timely decision making
- More accurate information
- Better reporting
- Political response
- Goodwill in the community
- Personnel morale



### **Step 3.1 Set up the Intangible Benefit Worksheet**

The Intangible Benefit Worksheet documents benefits that cannot realistically be measured in terms of dollar value. Word processing software may be more convenient to use for this worksheet, since it is text oriented.

Appendix C contains a sample Intangible Benefit Worksheet and instructions.

### **Step 3.2 Document the Intangible Benefits for Each Alternative**

Support intangible benefits by examples of similar issues that have known cause and effect relationships, known attitudes of management team members, effects on personnel, and expected business efficiency improvements. Clearly and concisely state the qualities of the intangible benefit and logically construct the conditions under which the benefit will impact the alternative.

## **STEP 4. EVALUATE ECONOMIC CONSIDERATIONS**

Each alternative is evaluated on its costs and benefits. This step consolidates the information collected through analysis of the alternatives and evaluates them using standard criteria.

### **Step 4.1 Set up the Economic Analysis Worksheet**

Alternatives are described on separate worksheets listing the four cost categories and the total benefit value from the Benefit Worksheet. When completed, the form provides an overview of the alternative. The cumulative cost/benefit, and payback period represent the economic measures of the alternative.

The case study in Section 3 describes methods for determining the economic viability of each alternative. Examples of Payback, Net Present Value, and Internal Rate of Return are shown. Any method accepted as part of standard accounting procedures and fitting the needs of an organization can be used. Other cost justification approaches used for financial comparison of alternatives include:

- Break Even Analysis
- Return on Investment (ROI)
- Discounted Cash Flow (DCF)

These approaches may be used to supplement or replace the approaches used in the case study.

Appendix D contains a sample Economic Analysis Worksheet and instructions.

### **Step 4.2 Prepare the Alternative Comparison Summary Worksheet**

Comparison of the total benefits and total costs for all alternatives is done on this form. The form gives an overview of the competing solutions and can be used as a cover to more detailed presentations. Each alternative is shown with the baseline alternative listed first.

Appendix E contains a sample Alternative Comparison Summary Worksheet and instructions.

**Step 4.3 Prepare the Recommendation**

Prepare the recommendation, report, and presentation in a format prescribed by management. If no such format exists, develop formats and displays that clearly depict each alternative and identify the recommended alternative. Expenses for operating the existing technology can be represented on the same graph for a comparison of the present and alternative costs.

Anticipate areas of discussion, including intangible benefits, and prepare charts and graphs to display critical elements such as payback comparisons. Intangible benefits should be presented and discussed to ensure that their implications are understood.

The recommendation conveys an understanding of the problem faced by the agency, the alternatives considered, the alternative chosen to solve the problem, and the costs involved in implementing the recommended solution.

**CONCLUSION**

Full responsibility for the final decision lies with the agency's senior management. This guideline presents a methodology which supplies a financial based recommendation along with alternatives from which management can make a realistic choice. The guideline's approach fully recognizes and supports the fact that many information technology decisions are not based solely on cost, but take management and technical issues into account as well.

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## SECTION 3

### CASE STUDY

*An Investment Analysis study was recently completed for the Probation and Parole function within the Commonwealth of Virginia, Department of Corrections. Many of the tools and techniques discussed in this guideline are illustrated in the following section using the results of that study.*

The results of the case study will supply answers to the following questions:

- How does this acquisition leverage attainment of the overriding goals of the organization?
- What are all the benefits?
- What are all the costs?
- What are the most important benefits?
- How will we manage the project to realize these benefits?
- What are the risks? How can we minimize risk?
- Should we proceed?
- How will we measure success?

### PREPARATION

#### 1. Determine Useful Life of the Acquisition

Most investment analyses look five years into the future. Some IT investments, however, such as a new technical architecture, have an economic life closer to 10 years. For this reason, it is important that a determination be made as to what is a reasonable time frame to truly represent the longevity of the acquisition. It is imperative that the same time frame be used to evaluate all alternatives being considered.

#### 2. Financial Measurement

Appropriate financial metrics to summarize the financial results must be chosen. There are several generally accepted financial tools that government and private industry utilize as explained below. This case study uses Payback in conjunction with Net Present Value to evaluate and compare alternative investments. The Internal Rate of Return is presented here as a third tool that is available for use at the discretion of the agency.

2. A. *Payback* The payback method determines the time necessary for a new investment to pay for itself. Payback does not measure profitability, but cash recoverability. Payback tends to show the risk factor by pointing out the recovery time of an investment. Its primary advantage is its simplicity - it is quick to calculate and easy to understand. Its limitations include:

-Does not consider the benefit of net results after the investment has been repaid - it is a break-even measurement, not a profitability measurement; and

-Does not take into account the time value of money.

	YEAR					
Project A	0	1	2	3	4	5
Total Net Benefit		60	60	60	60	60
Initial Investment	200					
Project B	0	1	2	3	4	5
Total Net Benefit		80	75	70	65	0
Initial Investment	200					

*In the above example, the payback of project A is 3.3 years. This is determined by adding the expected annual cash flows until the original investment has been recovered. Thus, by the end of year 3, \$180,000 of the original investment has been recovered; and, about one third of the way into year 4, the final \$20,000 of the initial investment would have been recovered. Following this procedure for investment B, the customer discovers that the payback for this equipment is 2.6 years.*

(See Appendix D for the formula to calculate Payback)

2. B. *Net Present Value (NPV)* The NPV financial tool incorporates the time value of money. NPV discounts future cash inflows and cash outflows to their present value and then totals these values to arrive at a net positive or negative result.

If the present value of cash inflows (positive) is greater than the present value of the expected cash outflows (negative), then the investment being evaluated will provide a return in excess of the discount factor (hurdle rate) used by the organization. In this case, the result of the calculation will be a positive number representing the net present value of the project's expected dollar benefit.

Conversely, if the present value of the cash outflows (negative) is greater than the present value of cash inflows (positive), then the result will be negative, indicating that the investment is earning a return less than the organization's hurdle rate. The NPV of an investment basically expresses the net benefits in today's dollars. Generally speaking, if the NPV of a discretionary investment is not a positive number, the investment should not be made.

*In the example below, we see that project B is the more favorable investment. With an NPV of \$5448, this project will earn a return greater than the hurdle rate of 16% set by management. In the table below, the projected cash flows each investment generates are discounted at a 16% rate and then totaled with the initial investment (cash outflow) of \$200,000. The result is the Net Present Value.*

Year	Present Value of \$1	Cash Flow	Discounted Cash Flow	Cash Flow	Discounted Cash Flow
0	1.0	(200,000)	(200,000)	(200,000)	(200,000)
1	.862	60,000	51,724	80,000	68,966
2	.743	60,000	44,590	75,000	55,737
3	.641	60,000	38,439	70,000	44,846
4	.552	60,000	33,137	65,000	35,899
5	.476	60,000	28,567	-0-	-0-
NPV			(3,543)		5,448

(See Appendix D for a formula to calculate NPV)

2. *C. Internal Rate of Return (IRR)* Whereas the net present value method produces a positive or negative dollar figure, indicating whether the proposed investment will earn a return greater or less than the organization's hurdle rate, the result of the internal rate of return method is a percentage amount. This percentage figure represents the actual rate of return earned by the investment. The IRR of an investment is determined by trying different discount rates in the above NPV calculations until the resultant NPV equals 0. When the NPV equals exactly 0, the rate of return of the investment is the same as the discount factor. The IRR basically expresses the percent return this investment is providing to the agency.

*In the example below, the IRR for project A is somewhere between 15% and 16%, because it is in this range that the net present value will equal 0. The IRR for this project is actually 15.2 percent. The IRR for project B, on the other hand, is higher (between 17% and 18%). By trying different discount rates, you would find that the NPV of project B equals 0 at a rate of 17.3 percent.*

Net Present Values		
Discount Rate	Project A	Project B
15%	1,129	9,466
16%	(3,543)	5,448
17%	(8,039)	1,558
18%	(12,370)	(2,209)

(See Appendix D for the formula to calculate IRR)

### 3. Read Existing Documentation

The last step in the preparation process requires the solicitation and perusal of all relevant documentation. This shortens the length of the analysis by precluding redundancy and grounds/acclimates the individual(s) to the environment surrounding the investment.

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*During the preparation for the Probation and Parole (P&P) Investment Analysis, the process uncovered a recent Workload Measurement Study which researched and described many of the concerns within the Commonwealth of Virginia, Department of Corrections (DOC). The study specifically investigated how P&P Officers were spending their time. A thorough reading of this report primed the individuals who were performing the analysis with a better understanding of the current issues/concerns within DOC and could better focus their efforts.*

## **RESEARCH**

It is necessary to have a thorough understanding of the current environment BEFORE the investments impact. At this point, it is not desirable to have an intimate awareness of the functionality of the proposed investment. Being too familiar with the proposed investment at this point could prejudice the collection of data in favor of the investment, i.e. having a solution looking for a problem.

### **1. Conduct Interviews and/or Surveys**

There are two primary ways to collect data: Interviews and surveys. Interviews are face-to-face conversations between an interviewer and the interviewee that are structured around a formal questionnaire. Interviewees should be selected from all organizations that could be effected by the proposal and must include inputs from all levels of the organization - from senior level management to end-users.

While interviews tend to be time-consuming, their primary advantage is that the questions often lead to open discussions which provide valuable insights into the organization's issues, problems, opportunities, etc. These insights can only be gained via the conversational interaction of interviews. Surveys, on the other hand, canvas a much larger audience and can provide more raw data. The quality of the data, however, is hindered by a lack of interaction. The survey method of data collection is less likely to bring all clients' issues out in the open.

It is recommended that the agency utilize the interview method of data collection. In many cases, it may be profitable to do both: a broad survey of many, with selected interviews, especially with survey respondents who indicate problems or needs.

### **2. Questionnaire**

A questionnaire must be prepared in advance to guide the interview. The questions included in the questionnaire must address:

- What are the goals, mission statements, strategies and/or objectives of the organization?
- What are the primary activities performed by the organization?
- How are these activities performed and by how many people?
- Who is depending upon your organization and for what?

- How much is it costing to do your work?
- What isn't being done that should be?

(See Appendix B for an Initial Data Collection Questionnaire)

### 3. Goals & Objectives

A thorough understanding of an organization's current environment must start with a clear articulation of the overriding goals and supporting strategies of that organization.

Without clear goals and objectives, it will be very difficult for any organization to demonstrate how an acquisition will indeed leverage attainment of those goals. A thorough Investment Analysis will uncover and articulate the mission of the organization.

*The Goals of DOC were identified via interviews of key DOC personnel and subsequently prioritized during a facilitated discussion. They are:*

- Maintain Public Safety
- Optimize DOC Resources
  - Provide Least Costly Solution*
  - Participate in "Project Streamline"*
  - Value Human Resources*
- Help Offenders Become Law-Abiders
  - Provide Progressive Sanctions/Client Services*
- Increase Public and Community Involvement

*The Investment Analysis team members intuitively recognized that the IT acquisition would most likely increase the productivity of P&P officers, i.e. free up their time. Identification of the primary goals of the organization, however, gave the valuable clues as to the best redeployment of this freed up time. The more important benefits of an IT investment must leverage these goals. Productivity improvements alone do not link to the purpose of an agency and must be thought through to their ultimate benefit.*

### 4. Primary Activities with Costs

The second ingredient needed to gain a thorough understanding of the current environment is a description of how work is currently being performed and their associated costs. At a minimum it is necessary to extract the primary activities being performed and resources being consumed by their performance. Resources can be measured in time, manpower, etc. but must eventually be translated into corresponding dollars.

*The DOC Workload Measurement Study documented how P&P officers were spending their time.*

*By verifying the results of this study, the Investment Analysis was able to thoroughly understand the primary activities being performed and the amount of time and associated dollars consumed by their performance. Next, the current activities were juxtaposed against the DOC goals. It became clear that a large percentage of current resources were used up in the performance of*

*activities that did not leverage goals. This uncovered the most fertile ground for significant opportunities which the team later translated into important benefits.*

## 5. Scrutinize Investment

Attention can now be focused on the proposed investment. While it's exciting to consider the bells and whistles of new technology, the focus must concentrate on the business functionality of the proposal.

While the technical specifications of the eventual system design must ensure that storage, I/O, speed etc. are adequate, this is not the concern of the Investment Analysis. It must be assumed that the technical specifications will provide a given functionality. Their job is to determine the impact that functionality will have upon the work of the organization. To gain an appropriate understanding, it is helpful to compile a list of the primary activities envisioned in the To-Be environment, i.e. after the investment is installed and fully operational.

*The IT acquisition under consideration by DOC involved the automation of several investigative forms, automated compliance reporting, and electronic mail capability.*

## 6. Classify & Size Benefits

Once a thorough understanding of the functionality of the proposed investment from a business perspective has been gained, the next step is to compile a preliminary list of potential benefits. This list should not be limited to those benefits that can be readily quantified.

	DIRECT BENEFITS	INDIRECT BENEFITS	STRATEGIC BENEFITS
COST REDUCTION	Labor Reduction Expense Reduction Asset Reduction		N/A
COST AVOIDANCE	Less Future Hiring Lower Future Assets Lower Future Expenses		N/A
REVENUE ENHANCEMENT	N/A	N/A	Revenue from New Services Faster Revenue  Improved Services

DIRECT BENEFITS - Benefits that occur within the investing group

INDIRECT BENEFITS - Cross-functional, i.e. benefits that occur outside the investing group

STRATEGIC BENEFITS - Benefits which result from achieving strategic goals.

*The direct benefits to DOC from the proposed IT investment were relatively easy to identify. Reduced paper expenses, mail costs and reliance on centralized computer systems were all readily apparent benefits. Indirect benefits, however, required careful, step-by-step logic.*

*The DOC Investment Analysis began the identification of indirect and strategic benefits by first verifying that the best use of the freed up officer's time would be to increase client contact. This was seen as the most direct way to leverage departmental goals.*



*Having established, therefore, that the technology would increase the amount of time an officer would dedicate to direct supervision of clients and/or referrals to rehabilitative programs, the next step involved identifying potential consequences: Reduced recidivism and a possible shift of sentencing alternatives from incarceration to less costly intensive supervision. The individuals performing the analysis reasoned and verified that clients would be more likely to remain law abiding, given improved supervision, and thus save the Commonwealth the cost of subsequent incarceration. Furthermore, judges would be more likely to choose the less costly alternative if the supervision time of intensive probation did, in fact, increase.*

*Another indirect benefit that demonstrated cause and effect logic included the timeliness of the investigative information used by the courts for sentencing decisions. Again, the individuals performing the analysis reasoned and verified that automation would enable more timely and accurate information to the courts for sentencing decisions. The indirect benefit would be an earlier release to probation from local jails and earlier release on parole. Both events save incarceration costs.*

## 7. Quantify the Intangibles

Many of the benefits from IT investments are not readily quantified. Even bona fide impacts that enjoy a high probability of actually occurring could be excluded from the financial results because assigning a dollar value to that occurrence is not a straightforward process.

It is inaccurate, however, to exclude hard-to-quantify benefits from the financial results simply because we cannot measure their impact with a high degree of precision. Instead, we must try alternative methods to assign dollar values to each of these intangibles on a case-by-case basis.

Several approaches to assigning a value to hard-to-quantify include:

*-Bayes Theorem.* Using the subjective, prior knowledge of operational experts within the organization, assign a range of dollar values to a given benefit and assign a corresponding probability percentage to a series of values within the range. The values that are most likely to be realized are given the highest percentages, and those least likely to materialize are given the lowest percentages. The total of all percentages must equal 1. The selected values are multiplied by the percentages, and the results added. This sum of the multiplication results is the single amount used to represent the benefit value.

Example: In the following example, Bayes Theorem is used to estimate the number of hours per week that would be saved as a result of using automated productivity tools.

Hours Saved	X	Probability	=	Extended
2		5%		.10
5		5%		.25
10		50%		5.00
15		30%		4.50
20		10%		2.00
		100%		<u>11.85</u>
Total used for quantification is 11.85 hours per week.				

*-Quantify the Direct Effects.* For example, given the benefit of improved working conditions, we may feel certain that we will realize this benefit but are unsure how to assign a dollar value. The sum of quantified direct effects such as lower absenteeism, lower turnover, faster job mastery, etc. will approximate the total value of the benefit.

*Familiar Comparisons.* Ask  
Could you buy this benefit for \$X?

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*-Solve for the Unknown.* Calculate the financial results without the unquantified value and determine what the value of the unquantified would have to be to make the financial results acceptable. Then ask: Would you pay \$X for this benefit?

*-Supportive Planning.* If careful and credible planning is done to capture a given benefit, the risk is mitigated and we can assign a relatively higher dollar value with confidence.

This guideline offers these as suggested means to quantify intangibles. They should be applied at the discretion of the agency.

## 8. Verify Benefits

Once a preliminary list of potential benefits has been compiled, these benefits must be verified with key personnel. Selected interviews are conducted to ensure that the benefits are indeed accurate and to ensure that the logic employed to quantify the value of the benefits is valid. Additional benefits might also be uncovered during the verification interviews.

*The DOC Investment Analysis required that verification interviews be conducted with select judges from throughout the Commonwealth. They confirmed that an increase in officer's time dedicated to client contact results in increased utilization of less costly sentencing alternatives. Likewise, they substantiated the argument that more timely information would enable faster sentencing to probation. Their corroboration was essential - without their agreement and subsequent cooperation, the investment could not leverage these important benefits.*

(See Appendix B for a Benefits Verification Questionnaire)

## 9. Classify & Size Costs

The same rigor and thoroughness that is employed to uncover benefits must be employed to uncover costs:

### ONE-TIME

- Hardware
- Software
- Network
- Installation
- Training (users and IS staff)
- Change Management
- Conversion
- Disposition of existing equipment, if any
- Facility preparation taking into account the following environmental factors:
  - Noise Emission
  - Power Requirements (line volts and watts usage)
  - Heating and Cooling
  - Computer Footprint
  - Security

### ONGOING

- IS Staff including:
  - Computer Operations
  - Applications Programmer/Analyst

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Systems Programmer/Analyst  
Managers/Supervisors  
Communications, Database, Other  
Maintenance contracts  
Utilities

(See Appendix A for Index Groups Comprehensive Cost of Ownership Model)

*The DOC Investment Analysis realized that the P&P workforce was comprised of professionals whose successful job performance did not include the use of computer technology. P&P officers gained job satisfaction by the help and direction they provided their clients - not by how quickly or accurately they completed paperwork.*

*The successful implementation of the IT acquisition and its resultant benefits, however, depended upon the acceptance and full utilization of the automated tools by P&P Officers. Therefore, to ensure timely implementation, effective learning and full utilization of the system, the analysis included an appropriate estimate for training and change management related costs.*

## ANALYSIS

### 1. Spreadsheet Modeling

At this point, the data must be captured in a spreadsheet model. The model must include all the categories that will be impacted and extend out for the economic life of the investment. A template is constructed to be used for the current environment, the "To-Be" environment and the resulting difference:

-The values placed in the cells of the current environment model will represent the current cost structure before the investment. This base case should also reflect the cost of not automating and include known changes expected to occur independent of the investment.

-The values placed in the To-Be model must reflect the anticipated cost structure after the investment.

-The third and final model is simply the difference between the first two and represents the net effects. It is this third model which will be used to summarize the financial results and calculate the financial measurements (NPV, Payback, IRR, etc.)

(See Appendix E for a Spreadsheet Template)

### 2. Sensitivity Analyses

Identification of those variables which are critical to the financial success of the proposal enables management to carefully monitor the right variables during implementation and ongoing operations. Sensitivity analysis is a recommended method to identify these critical variables.

To perform sensitivity analyses, select one variable and change its value by 50% (reduce it by one-half). While holding all other variables constant, recalculate the financial results. Record the change in NPV. Now return that variable to its original value and choose another variable. Change its value by 50% and recalculate the financial results. Again, record the change in NPV. Repeat the process until you have tested all germane variables. Compare the results using the following table:

VARIABLE	VALUE	NPV	50% VALUE	NEW NPV	CHANGE IN NPV	RANK
Category	\$x,xxx	\$x,xxx	\$x,xxx/2	\$y,yyy	(\$x,xxx-\$y,yyy)	X

Where,

Value = Original value in financial model, and

NPV = Original NPV calculated, and

50% Value = Original value X .5

New NPV = NPV recalculated with 50% value

Change in NPV = Original NPV - New NPV

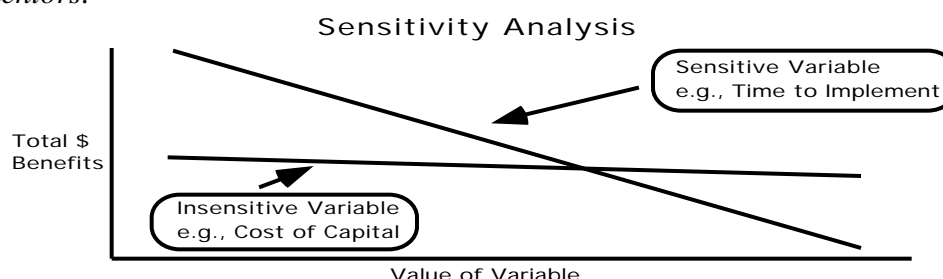
Rank = Those variables which have the most dramatic change in NPV ranked in descending order.

Example:

Those variables which independently have the most significant impact upon the summary financial results, i.e. NPV, will be ranked accordingly and thus provide management with the focus they need to be managed accordingly.

VARIABLE	VALUE	NPV	50% VALUE	NEW NPV	CHANGE IN NPV	RANK
Labor Savings	\$1,234	\$756	\$617	\$254	\$502	2
Reduced Inventory	\$5,322	\$756	\$2,661	\$112	\$644	1

*The DOC Investment Analysis tested several variables for their relative sensitivity. The results of the analyses were graphically portrayed via proprietary software utilized by Digital Equipment Corporation's Investment Evaluation Methodology (IEM). The exercise revealed that the most sensitive variables were those that could in fact be managed, i.e. were under the direct control of the implementors:*



*As indicated, implementation time, learning time and utilization rates represented those factors most important to the overall financial results. Factors which were outside of the direct control of DOC were shown to be relatively less important to the overall financial results.*

### 3. Risk Analyses

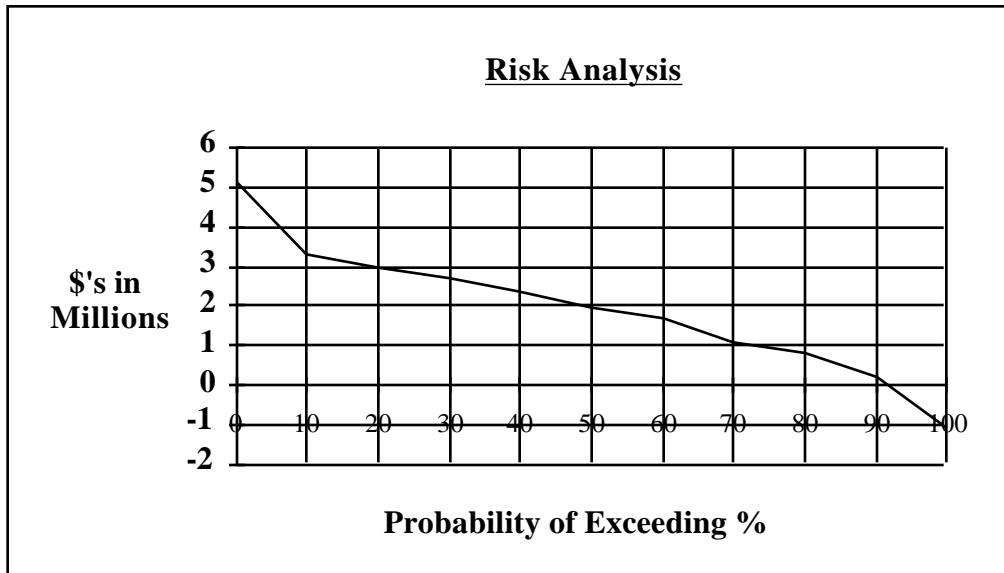
All investments involve some degree of risk. Decision makers should know the likelihood of achieving the forecasted results of a proposal in order to make prudent decisions. Furthermore, identification of the explicit risk factors will initiate effective countermeasures to mitigate risk where possible.

There are several methods of performing risk analysis. The simplest method adjusts the hurdle rate upward by a given percent to account for risk and recalculates the NPV. This method is simple to use but cannot account for the fact that some variables are more stable than others and as such are less risky. Arbitrarily raising the hurdle rate inaccurately assumes that each variable has the same degree of risk as every other variable.

A more thorough method assigns likely ranges of values to those variables that were determined sensitive (above) and/or had highly subjective values assigned to them, e.g. a quantified intangible. Once a range from high to low has been assigned, it is a relatively straightforward process to determine the worst case scenario by recalculating NPV using the lowest value in the range of each variable. Likewise, best case can be determined by recalculation involving the highest values in the range. (Assuming low equates to least favorable and high values equate to most favorable.)

More sophisticated methods perform hundreds of iterations by randomly selecting values within the ranges of all the variables simultaneously and recalculating the resultant NPV. The result of each iteration is plotted on a graph to provide a cumulative probability curve.

*The risk analysis performed for the DOC Investment Analysis employed a proprietary software package utilized by Digital Equipment Corporation's Investment Evaluation Methodology. The computer program performed 250 iterations by randomly selecting points within the specified variable ranges and plotted the results:*



There is a 90% Probability of Exceeding Break-even

There is an 80% Probability of Exceeding \$800K in Benefits

There is a 50% Probability of Exceeding \$1.9M in Benefits

*The graph tells DOC that there is a 50/50 chance of achieving \$1.9M in net benefits from this investment; and, there is an 80% chance of achieving \$800K in net benefits. The best we could hope to achieve is \$5.1M in benefits; worst case is a net loss of \$1.1M.*

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## APPENDIX A

### Comprehensive Cost of Ownership Model

	ACQUISITION AND IMPLEMENTATION	ANNUAL OPERATIONS AND MAINTENANCE	ENHANCEMENTS MODIFICATIONS
EQUIPMENT	Equipment Purchase Installation Costs	Maintenance Warranty Annual Lease/ Rental Charges	Hardware Replacement or Upgrades Deacquisition Costs
SOFTWARE	Software Purchase/one time license Initial charge	Annual license fees Maintenance fees Warranty	Software upgrades or replacement fees
PERSONNEL	Evaluation and Selection Training/Education Equipment and software installs Programming Contract programming	Routine monitoring and operations Problem determination and correction User liaison Administration Programming maintenance Training/Education	User changes Software changes & upgrades Training/education Programming Contract programming
COMMUNICATION CARRIERS	Initial hook-up charges	Monthly tariff charges	Additional lines Hook charges Tariff charges
FACILITIES	Facilities development Wiring costs Plumbing	Space expense Power Air cooling	Incremental wiring Incremental space expense

*Source: Index Group, a wholly-owned subsidiary of Computer Economics, Inc.  
5481 Edison Place, Carlsbad, CA 92008*

**APPENDIX A****SPREADSHEET TEMPLATE****COST WORKSHEET**

Agency Name

Date

Alternative Designation

Category	Reference Note	Fiscal Period				Total
		Period 1	Period 2	Period 3	Period 4	
Acquisition/Implementation						
Equipment		xxx	xxx	xxx	xxx	xxx
Software		xxx	xxx	xxx	xxx	xxx
Personnel		xxx	xxx	xxx	xxx	xxx
Communication		xxx	xxx	xxx	xxx	xxx
Facilities		xxx	xxx	xxx	xxx	xxx
Acquisition/Implementation Total		xxx	xxx	xxx	xxx	xxx
Annual Operations/Maintenance						
Enhancements/Modifications *						
Total Costs		xxx	xxx	xxx	xxx	xxx

\* Subdivide the annual operations/annual maintenance and enhancements/modifications categories using the same five subcategories shown under acquisition/implementation.



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## APPENDIX A

### Cost Worksheet

PURPOSE - This worksheet documents the costs of each alternative.

#### USAGE

##### Categories

The cost categories chosen for an analysis are determined by what is appropriate to the technology under consideration. Each category may have subordinate cost categories representing areas that contribute to the primary category. This category breakdown is carried to the point where proper cost line detail is shown. When appropriate the cost categories should conform to the expenditure categories described in the Budget Development Expenditure Structure published by the Virginia Department of Planning and Budget.

##### Reference Note

The reference note column links background information and calculations to the associated line entry. Vendor bids and cost calculations are examples of reference note entries.

##### Fiscal Period

A fiscal period is the time period used to measure an alternative's costs and benefits (savings). The number of periods used depends on the estimated life expectancy of the technology. Most analysis uses annual time periods.

All cost estimates are given in constant dollars. Using constant dollars allows spending comparisons throughout the expected life of an alternative without the complication of price changes in the later periods.

## **APPENDIX B**

### **Questionnaire for Initial Data Collection**

1. What are the agency's/function's/group's major goals and strategies?
2. How will your organization change over the next five years?
3. Who are your customers/constituents? What do you provide to your customers/constituents?
4. What is your "service"? How do your activities fit in with delivering that service?
5. What is success to you and to your managers? How is that success measured?
6. What are the step-by-step activities that occur in your group to get your "service" to your "customer"?
7. How does your group interact with other groups? Who are you dependent on and who is dependent on you for success?
8. How many people are involved in your group? How many projects, activities? What is the average project time?
9. What are your average costs of labor and other factors?
10. Where do you see the most problems in accomplishing your job (in your group, department, agency)?
11. What are the major problem areas you plan to address this year? How do you rank them in importance?
12. How does this problem hurt your group, department, agency, etc.? Are you losing time, money, quality, etc.? How much? What is the impact to your group and your agency?
13. What problems are on your goal sheet for this year?

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## APPENDIX B

### Questionnaire for Benefits Verification

1. What benefits do you expect to see from these proposed changes? Can you see [specific benefit] occurring?
2. How much improvement do you expect in time, quality, cost reduction for labor, materials, etc., cost avoidance for labor, etc., revenue?
3. Will all the benefits occur in your area [direct benefits] or will some occur in other areas [indirect benefits]?
4. Do you agree that this proposal can help you address your problems?
5. Do the benefits look right to you and do you believe that this solution will generate benefits in the estimate ranges?
6. Here are some additional benefits that we have uncovered. Do you think you could see any of these occurring with this investment?
7. Are there any potential benefits missing from the list?
8. Are there any additional expenditures that you may need to make if you implement this solution that I am proposing?
9. How would you use any time benefits achieved by this investment? To lower labor costs, increase revenues or a mixture of the two?
10. I have made a summary sheet of the expected amount of benefits that we agreed could result from this investment, could you please help me estimate the dollar value for each of these?
11. What percentage of each of the benefits we discussed earlier do you feel could be attributed to my proposal?
12. Do these benefit estimates look okay? If not, how would you change them?
13. What is high, low, most likely levels of benefits you would expect to see from implementing this proposal?
14. Do you feel that you have all the information you need and that your managers need to understand the value of this proposal to your business?
15. Do you need to understand the strategic impact of this investment, how it will change the way you do business, and how to manage it to achieve your desired goals and benefits?
16. How can we prove the value of this investment to your senior managers?

**APPENDIX B****Benefit Worksheet**

Agency Name

Date

Alternative Designation

Category	Reference Note	----- Fiscal Period -----				
		Period 1	Period 2	Period 3	Period 4	Total
Tangible						
Increased Revenue						
1. Benefit Name		xxx	xxx	xxx	xxx	xxx
2. Benefit Name		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Sub Total		xxx	xxx	xxx	xxx	xxx
Cost Avoidance						
1. Benefit Name		xxx	xxx	xxx	xxx	xxx
2. Benefit Name		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Sub Total		xxx	xxx	xxx	xxx	xxx
Cost Reduction						
1. Benefit Name		xxx	xxx	xxx	xxx	xxx
2. Benefit Name		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Sub Total		xxx	xxx	xxx	xxx	xxx
Semi-tangible						
1. Benefit Name		xxx	xxx	xxx	xxx	xxx
2. Benefit Name		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Sub Total		xxx	xxx	xxx	xxx	xxx
Total Benefits		xxx	xxx	xxx	xxx	xxx

**APPENDIX B****Semi-tangible Explanation**

Agency Name

Date

Alternative Designation

Reference Note Entry

## 1. Semi-tangible Benefit Name:

Description:

Assumptions:

Calculations and Values:

## 2. Semi-tangible Benefit Name:

Description:

Assumptions:

Calculations and Values:

## APPENDIX B

### Benefit Worksheet

**PURPOSE** - This worksheet documents the tangible and semi-tangible benefits associated with each alternative.

#### USAGE

##### Category

Tangible benefits are listed under the appropriate category. Semi-tangible benefits are listed, described, and valued on the Semi-tangible Explanation sheet, and then listed under the semi-tangible category. Each category may have subordinate benefit categories representing areas that contribute to the primary category. Continue the category break down until the point where appropriate cost detail is shown. When appropriate the benefits should conform to the expenditure categories described in the Budget Development Expenditure Structure published by the Virginia Department of Planning and Budget.

##### Reference Note

The Reference Note column links background information and calculations to the associated line entry. All semi-tangible benefits are described, discussed, and calculated on the Semi-tangible Explanation sheet. The resulting semi-tangible value is shown on the appropriate Benefit Worksheet line. Document as many semi-tangible benefits on a single sheet as space allows.

##### Fiscal Period

Use the same fiscal periods that are used for the Cost Worksheet. These periods show dollar savings for each listed benefit.

**APPENDIX C****Intangible Benefit Worksheet**

Agency Name

Date

Alternative Designation

## 1. Intangible Benefit Name:

Description:

Assumptions:

Advantages:

Conclusions:

Impact:

Benefit:

Risk:

## 2. Intangible Benefit Name:

Description:

Assumptions:

Advantages:

Conclusions:

Impact:

Benefit:

Risk:

## APPENDIX C

### Intangible Benefit Worksheet

**PURPOSE** - This worksheet documents all intangible benefits expected to be realized from the alternative. A single worksheet shows as many benefits as space allows.

#### USAGE

##### Intangible Benefits Name

The label or title identifies the specific benefit.

##### Description

Discussion of the benefit in enough detail to ensure understanding of the benefit.

##### Assumptions

The assumptions surrounding the benefit that make it important to this alternative.

##### Advantages

The positive aspects of the benefit as they relate to this alternative.

##### Conclusions

Conclusions reflect the impact of the benefit on the agency.



**APPENDIX D****Economic Analysis Worksheet**

Agency Name

Date

Alternative Designation

Category	Reference Note	----- Period Totals -----			
		Period 1	Period 2	Period 3	Period 4
Tangible Benefits					
Increased Revenue		xxx	xxx	xxx	xxx
Cost Avoidance		xxx	xxx	xxx	xxx
Cost Reduction		xxx	xxx	xxx	xxx
Semi-tangible Benefits		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Total Benefits		xxx	xxx	xxx	xxx
Costs					
Acquisition/Implementation		xxx	xxx	xxx	xxx
Annual Operations/Maintenance		xxx	xxx	xxx	xxx
Enhancements/Modifications		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Total Costs		xxx	xxx	xxx	xxx
Net Benefit/Cost		<u>xxx</u>	<u>xxx</u>	<u>xxx</u>	<u>xxx</u>
Cumulative Benefit/Cost		xxx	xxx	xxx	xxx
Net Present Value of Benefit/Cost	xxx				

Estimated Payback Period

Payback Period

x+ years

## APPENDIX D

### Economic Analysis Worksheet

**PURPOSE:** This worksheet summarizes the quantifiable benefits and the costs for an alternative.

**USAGE:**

#### Category

A list of all subtotal costs and benefit line items from the Cost Worksheet and Benefit Worksheet.

#### Net Benefit/Cost

Values determined by subtracting the *Total Costs* values from the *Total Benefits* values. Negative values are shown in parentheses.

The cumulative *Net Benefit/Cost* figure for each Fiscal Period is the sum of previous periods and the present one. Negative values are shown in parentheses.

#### Net Present Value (NPV) of Benefit/Cost

Represents the discounted value of the total benefits (savings) and costs for the alternative. Many spreadsheet packages support the NPV calculation within their software.

#### Net Present Value

The NPV method is applied in the following three steps:

1. Prepare a diagram of relevant expected cash inflows and outflows, including the outflow at time zero - the date of the acquisition.
2. Find the present value (PV) of each expected cash inflow or outflow.

$$\frac{\text{The formula for this is PV}}{(1 + i)^n} = S$$

where,  
 PV = Present Value,  
 S = Amount to be received or paid  
 n = the time period, and  
 i = the rate of interest.

*Note:* Rather than using the equation, the PV number can be obtained quite easily from a spreadsheet.

3. Sum the individual present values. If the total is zero or positive, the project should be accepted; if negative, it should be rejected.

Payback Period

Represents the time (number of fiscal periods) before the Cumulative net Benefit/Cost value becomes positive, with the shorter period being more attractive.

Payback

The basic approach to finding payback is to divide the cost of the investment by the annual earnings or net benefits, with each annual cash flow beginning with year one, and then determine the number of years required to recoup the initial outlay.

Mathematically speaking,

$$\text{Payback Period (PP)} = \frac{\text{Initial Cost (IC)}}{\text{Cash Flow (CF)}}$$

where CF = Benefits - Costs

for investment with equal annual cash flows. For unequal cash flows, add the annual cash flows beginning with year one and determine the number of years required to recoup the initial outlay.

Internal Rate of Return

The following three steps illustrate how the IRR can be evaluated:

1. Prepare a diagram of the expected cash inflows and outflows exactly as you calculated the NPV.
2. Find an interest rate that equates the present value of cash inflows to the present value of cash outflows. If one outflow is followed by a series of equal inflows, the following equation can be used: Initial Investment = [annual cash inflow] X [annuity PV factor(F)]. Once the annuity PV factor(F) is determined, the IRR is determined by looking at the interest table that has the interest rate with an annuity PV factor that is closest to the one that is evaluated.
3. Compare the IRR to the minimum desired rate of return. If the IRR is equal to or greater than the minimum desired rate, the project should be accepted; otherwise, it should be rejected.

Considerations in Selecting an Interest Rate

For consistency, whatever is the rate for a Treasury Loan is the rate that should be used for an agency.

Reference Note

This column cross references line entries to supporting documentation and calculations.

Fiscal Period Totals

Fiscal Period Totals are obtained from each alternative's Cost Worksheet and Benefit Worksheet.

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**APPENDIX E****Alternative Comparison Summary Worksheet**

Agency Name:

Date:

<u>Comparison Information</u>	<u>Alternatives</u>		
	<u>One</u>	<u>Two</u>	<u>Three</u>
Total Benefits	\$x,xxx	\$x,xxx	\$x,xxx
Total Costs	\$x,xxx	\$x,xxx	\$x,xxx
Net Benefit/Cost	\$x,xxx	\$x,xxx	\$x,xxx
Net Present Value@ xx% discount rate	\$x,xxx	\$x,xxx	\$x,xxx
Payback Period	x.x Yrs	x.x Yrs	x.x Yrs

**APPENDIX E****Alternative Comparison Summary Worksheet**

PURPOSE - This form shows key economic analysis information for each alternative.

**USAGE**Comparison Information

The five headings and the associated figures are from each alternative's Economic Analysis Worksheet.

Alternative

Each alternative has the same name or number used in previous references.

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## APPENDIX F

### Glossary

*Alternative:* One of two or more approaches to solving a perceived technological problem within an agency.

*Assumption:* A supposition, hypothesis, premise, or conjecture relative to and used throughout an economic analysis to establish alternatives.

*Bayesian Analysis:* An analytical technique that assigns probabilities of occurrence to ranges of values associated with semi-tangible benefits to establish a single value for evaluation purposes.

*Benefits:* Results anticipated in return for costs incurred. Benefits are measured in terms of cost savings, cost avoidance, and productivity increases. Benefits are divided into the following three categories:

- Tangible Benefits can be evaluated with a high degree of confidence in terms of dollar savings;
- Semi-tangible Benefits can be evaluated within a range of dollar savings with an acceptable degree of confidence;
- Intangible Benefits are those issues that cannot be quantified in terms of dollar savings with any certainty.

*Constant Dollars:* The purchasing power of dollars at the time of the analysis, projected for the life of the alternative without regard to price or inflation changes.

*Cost/Benefit Analysis:* An analytical approach for choosing between alternatives as the solution best suited to solving an agency's technological requirements.

*Cost Avoidance Benefits:* Those benefits that result from being able to eliminate or postpone the need to make other planned investments because this investment is made. For example: eliminating the need to hire the three new engineers you planned to hire next year.

*Cost-Effective Alternative:* The alternative that:

- a. Maximizes benefits when costs for competing alternatives are equal;
- b. Minimizes costs when benefits for all competing alternatives are equal;
- c. Maximizes productivity when benefits and costs of competing alternatives are equal.

*Cost Reduction Benefits:* Those benefits that accrue from being able to reduce the amount of expenditures already being made. For example: reducing the maintenance costs because of investing in a new system.

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*Cross-Functional/Integrative Benefits:* Those benefits that result from improvements in the process between functions.

*Direct Benefits:* Benefits achieved within the functions making the investment.

*Discount Cash Flow:* Usually performed with a specific investment analysis, it is a determination of the NPV of the investment's cash flows. The discount cash flow analysis is often used in selecting alternative investments where the time value of money is an important consideration.

*Discount Rate:* A percentage rate that consists of the weighted average cost of capital and some risk factor to account for the riskiness of the investment. The discount rate used is used for calculating the discounted cash flow when considering investment alternatives.

*Economic Life:* The period of actual usefulness of an asset. Economic life refers to the period beyond which it is cheaper to replace or scrape an asset than continue maintaining it.

*Hurdle Rate:* The minimum expected return an organization will consider in accepting investment opportunities. The hurdle rate is usually the discount rate.

*Indirect Benefits:* Benefits achieved in functions other than the ones making the investment.

*Internal Rate of Return (IRR):* IRR finds a rate of discount that will make the present value of the cash process from an investment equal to the present value of the cash outlays required by the investment.

*Net Present Value (NPV):* A method of discounting all future positive and negative cash flows from an investment by a discount rate to determine their overall present-day value.

*Payback Period:* The number of years before the investment pays for itself.

*Quantifiable Benefits:* Those benefits that can be estimated in monetary terms.

*Revenue Enhancement Benefits:* Those benefits that result in increased revenue. Also known as strategic benefits.

*Risk Factor:* The percentage rate that is added to the weighted cost of capital to determine the discount rate. This rate represents the implied riskiness of the investment and often there are different risk factors assigned to different investment types. Often the risk factor rate is chosen arbitrarily.

*Strategic Benefits:* Benefits which result from achieving strategic goals. Strategic benefits will normally be measured in increased revenue.

*Time Value of Money:* A term used to describe the fact that a given amount of money is more valuable in the present than in the future. This is because money, once available, can be employed or invested at a rate of return or interest rate.

*Unquantifiable Benefits:* Benefits that cannot be estimated in monetary terms, often referred to as intangible benefits.

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## APPENDIX G

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